

**TITLE: METHOD FOR REMOVING POLLUTANTS FROM THE AIR
AND APPARATUS THEREFOR**

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CROSS REFERENCE TO RELATED APPLICATION

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This application is a Continuation in Part of Application No. 10/272,181, filed 10/16/2002. Additionally, this application claims the filing benefit under Title 35, United States Code, §119(e) of United States provisional application 60/429,990, filed 11/27/2002.

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TECHNICAL FIELD

The present invention pertains generally to air purification, and more particularly to a method and apparatus in which an attachment to a fan blade is utilized to remove pollutants
20 from the air.

BACKGROUND OF THE INVENTION

25 Fans are commonly used to increase comfort by moving air and improving ventilation. Fans have been used in residential, institutional, and commercial facilities for many years and are manufactured by a number of companies worldwide. Those who have observed ceiling fans after some period of use recall the collection of dust and other airborne particulate matter on the fan blades, especially the leading edge. Even in what is normally thought to be a clean
30 environment, such as a residence, there is considerable airborne matter that collects while the fan is operating.

There exist a number of patents teaching the use of filters, or filter fasteners, blade covers or specifically designed blades to modify fans and/or their blades for capturing pollutants or foreign matter. For example, U.S. Patent 6,174,340 shows a room air filter apparatus including a multi-sided housing having longitudinally spaced first and second ends, a plurality of sides between the first and second ends, and a plenum inside the housing. Each of the sides has an empty space frame by outer edges of the housing side. A fan is mounted to the housing and is operably disposed, preferably, within the plenum to draw air from the plenum and to exhaust the air outside of the housing. Filter panels are removably attached to the outer surfaces of the edges and filter material is mounted in the panels to cover the empty spaces. Magnets mounted on edges of the panels may be used as attachment devices as well as other devices for clipping the panels onto the outer surfaces of the edges of the housing. The filter material is preferably a self-charging electrostatic washable material.

U.S. Patent 5,912,369 illustrates self-adhesive fibrous air filters that are universally compatible with devices that require filtered air and devices that provide filtered air. The self-adhesive air filters are fabricated from a flexible fibrous air filter blank composed of, for example, polyester batting, that is coated with an air permeable non-drying adhesive that has been vacuumed into the interstices of the fibers. A template serves as a protective cover for the non-drying adhesive and enables a user to shape and/or size the blank to configurations that are compatible with the air intake regions of the devices on which the self-adhesive air filters are to be installed.

U.S. Patent 5,795,131 discloses a ceiling fan for cleaning air in a room wherein each blade of the ceiling fan has a cavity open to the top and bottom surfaces of each fan blade and a filter unit in each of the cavities but within the confines of the fan blade such that, when the ceiling fan is operated, the airflow created by the ceiling fan will be forced through the filter unit from the bottom surface through to the top surface, wherein the filter units can collect airborne particles.

U.S. Patent 5,591,006 comprises a removable, washable decorative cover for each thin, flat fan blade of a paddle-type ceiling fan. The decorative cover includes a main sleeve of uninterrupted tubular shape, each end of which is open, and formed of highly elastic and expandable decorative fabric, preferably SPANDEX. The main sleeve is of sufficient elastic strength and sized substantially smaller in width than the width of the fan blade whereby, when

mounted over a preselected main portion in length of the fan blade, the gripping action of the elastically stretched fabric conformingly against the surface of the main portion of the fan blade is sufficient to prevent movement therebetween when the ceiling fan is in operation. The cover may also include an end sleeve formed of the same elastic fabric and transverse width, one end of which is open, the other end of which is closed. The end sleeve conformingly fits over the distal end of the fan blade in either spaced, abutting or overlapping orientation on the distal portion of the fan blade with respect to one open end of the main sleeve. The end sleeve is likewise of sufficient elastic strength, when stretched to cover the distal portion of the fan blade, to remain stationary on the distal end of the fan blade during ceiling fan operation

U.S. Patent 5,562,412 consists of a fan apparatus with a filter affixed to one or more of its fan blades such that the rotating fan blades carry the filter or filters through a medium to extract pollutants.

U.S. Patent 5,370,721 describes a ceiling fan filter for filtering the air in a room having a ceiling fan. The ceiling fan filter is made from at least one layer of resilient polymeric fiber filter material. Each layer has a length, a width, an upper surface, a lower surface and two side edges which extend along the length of the layer. A narrow compressed strip is formed in the filter material by compressing and heating the layer of filter material so that the filter material is fused together. The compressed strip causes an expanded thickness of the side edges to increase the effective filter surface area of the filter and gives the filter a semicircular cross-sectional shape perpendicular to the length of the filter. An adhesive layer is joined to the lower surface of the filter to attach the filter to the fan blade of a ceiling fan.

U.S. Patent 4,676,721 depicts a method and device for reducing the pollution of the air in a room equipped with a ceiling fan having one or more rotating blades comprising covering at least one blade of the fan with porous dust-absorbent material whereby movement of the fan blades removes pollution from the room air.

The above cited inventions are relatively cumbersome to use and maintain, or impractical for use especially in residential locations. None of these inventions effectively deal with the problem of improving air quality while operating the fan and having a means of inexpensively and conveniently renewing the pollutant and particulate matter adsorption surface.

SUMMARY OF THE INVENTION

5 The present invention is directed to a method and apparatus for removing pollutants from the air and thereby improving air quality. The present invention retains the comfort factors and functionality associated with the use of a fan, such as a ceiling fan, and expands its use for improved adsorption of undesirable pollutants such as particulate matter, without the use of a filter. This invention encompasses the manufacture or modification of a fan and more specifically the blades of a ceiling fan or similar air moving device with an exposed tacky surface preferably over the blade leading edge to which undesirable airborne particulate matter adhere as the blade moves, thus reducing the environmental hazard and improving air quality. It may be appreciated that a moving (or stationary) fan blade does collect some amount of pollutants. Due to its tacky substance, the present invention greatly enhances and expedites the collection process.

15 Those who have observed fans and more specifically ceiling fans in use can recall the collection of dust and other particulate matter collected on the fan blades, especially the leading edge. Even in what is normally thought to be a clean environment, such as a home residence, there is considerable airborne matter that collects while the fan is operating.

20 The present invention takes advantage of the rotating fan blade to carry and support an exposed, renewable, tacky adsorption surface to facilitate the collection and retention of the airborne particulate matter without degrading the functionality of the fan itself. As the blade rotates through the air, the particulate matter is adsorbed on the tacky surface. When the surface of the exposed tacky layer is fully or nearly fully covered with pollutants, it is removed and a new clean tacky surface is applied or exposed.

25 In a preferred embodiment of the invention pollutants are removed from the air. However, it may be appreciated that the principles of the invention may be more generally applied to removing pollutants from any gas.

In accordance with a preferred embodiment of the invention, a method for removing pollutants such as dust, pollen, particulate matter, germs, and the like from a gas such as air, includes:

(a) providing a fan having a fan blade having a surface;

(b) providing a plurality of sheets, each sheet of the plurality of sheets having a first side and an opposite second side, each sheet having a tacky substance disposed upon the first side, the plurality of sheets arranged in stacked multi-layer relationship wherein the first side of each sheet faces in a same direction, the plurality of stacked sheets having a top sheet and a bottom sheet, and each sheet having a tab which facilitates removal of the top sheet from the stack of sheets;

(c) attaching the second side of the bottom sheet to the surface of the fan blade so that the first side of the top sheet is exposed to the air; and,

(d) causing the fan blade to rotate through the air.

Other aspects of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a fan with the air purification device of the present
5 invention attached thereto;

FIG. 2 is an enlarged cross sectional view along the line 2-2 of FIG. 1;

FIG. 3 is an enlarged exploded view of area 3 of FIG. 2;

FIG. 4 is an enlarged view showing a top sheet being removed from a multi-layer stack
of sheets;

10 FIG. 5 is an enlarged view showing a bracket connecting a multi-layer stack of sheets
to the surface of the fan blade;

FIG. 6 is an enlarged view showing a stack of sheets attached to the top surface of the
fan blade;

FIG. 7 is an enlarged view showing a stack of sheets attached to the bottom surface of
15 the fan blade;

FIG. 8 is an enlarged view showing a stack of sheets attached to the bottom surface of
the fan blade and wrapped around the leading edge of the fan blade;

FIG. 9 is an enlarged exploded view showing a peel off cover being removed in order
to attach a stack of sheets to the surface of the fan blade;

20 FIG. 10 is a perspective view of the fan with an alternative embodiment of the air
purification device of the present invention attached thereto;

FIG. 11 is an enlarged view in direction 11 of FIG. 10;

FIG. 12 is another enlarged view in direction 11 of FIG. 10;

FIG. 13 is another enlarged view in direction 11 of FIG. 10; and,

25 FIG. 14 is an enlarged cross sectional view of an alternative embodiment.

DETAILED DESCRIPTION OF THE INVENTION

Referring initially to FIG. 1, there is illustrated is a perspective view of a fan 500, such
5 as the shown ceiling fan, with an air purification device 20 of the present invention attached
thereto. Fan 500 includes a plurality of fan blades 502, each fan blade 502 having a surface
including a top surface 504 and a bottom surface 506 (refer to FIG. 2), a leading edge 508, and
a length L.

FIG. 2 is an enlarged cross sectional view along the line 2-2 of FIG. 1, and FIG. 3 is an
10 enlarged exploded view of area 3 of FIG. 2. Air purification device 20 includes at least one
sheet 22 having a first side 24 and an opposite second side 26. A tacky substance (indicated by
the heavy line on each sheet 22 in FIG. 3) is disposed on first side 24. In an embodiment of
the invention, the tacky substance can be acrylate or elastomeric copolymer containing
microspheres as disclosed in U.S. Patent Nos. 3,691,140 issued to Silver on Mar. 3, 1970 and
15 3,857,731 issued to Merrill et al on Apr. 6, 1973 and assigned to Minnesota Mining and
Manufacturing Co., St. Paul, MN. While a single sheet 22 could be employed, in the shown
preferred embodiment of the invention, a plurality of sheets 22 are arranged in stacked multi-
layer relationship, so that as a top sheet 22 becomes contaminated with airborne pollutants it
may be removed to expose an uncontaminated next lower sheet 22 below the contaminated
20 sheet 22. Such a multi-layer pad or packet of tacky adsorption surface coated substrates is
illustrated by the "Post-It" (RTM, 3M Co.) brand products and specifically the pressure
sensitive adhesive used between each sheet of paper in a "Post-It" (RTM, 3M Co.) pad. It may
be appreciated that in FIG.s 2 and 3 the sheets 22 are shown spaced apart for clarity. In
actuality the sheets 22 are pressed together into a packet or pad (such as a note pad) wherein
25 the tacky substance on the first side of a sheet 22 bonds that sheet 22 to the second side of the
next sheet 22 in the stack.

Sheets 22 may be fabricated from a variety of thin materials such as paper, a polymer,
or metal. In one embodiment of the invention, each stack or pad of sheets 22 contains 12
individual sheets, however a lesser or greater number could also be employed.

30 The second side 26 of sheet 22 is attachable to the surface of fan blade 502 by an
adhesive and/or a mechanical connector so that first side 24 faces outward and is exposed to

the air. In the embodiment shown in FIGs. 2 and 3, and double sided adhesive strip 28 attaches the second side of the bottom sheet 22 of the stack to the surface (top surface 504 shown, or bottom surface 506, refer to FIG. 7) of fan blade 502. With sheet 22 or stacked sheets 22 so attached, as the fan blade 502 rotates, first side 24 collects pollutants from the air.

5 Sheet 22 or stack of sheets 22 are wrappable around the leading edge 508 of fan blade 502 (also refer to FIG. 1). Also referring to FIG. 1, in an embodiment of the invention sheet 22 or stack of sheets 22 define an elongated strip which may be wrapped along at least half of the length L of fan blade 502, so that an ample amount of tacky substance is exposed to the air.

It may be appreciated that fan 500 may have a plurality of fan blades 502, and that at
10 least one sheet 22 or a plurality of sheets 22 are attachable to each of the plurality of fan blades 502. In another embodiment of the invention, sheet 22 includes at least one of (1) a fragrance, (2) a biocide, (3) a dye or pigment colorant, and (4) a decorative pattern.

FIG. 4 is an enlarged view showing a top sheet 22 being removed from a multi-layer stack of sheets 22. The first side 24 of the top sheet 22 has become contaminated (full or
15 nearly full) of airborne pollutants so that its capacity to adsorb pollutants is diminished. Consequently, top sheet 22 is peeled off of stack of sheets 22 to expose the next lower sheet 22 in the stack which has a fresh and uncontaminated tacky first side 24.

FIG. 5 is an enlarged view showing a bracket 30 connecting a multi-layer stack of sheets 22 to the surface (top surface 504) of fan blade 502. Bracket 30 is disposed between
20 sheet 22 (bottom sheet 22 of a stack of sheets 22) and the surface of fan blade 504 so that sheet 22 (stack of sheets 22) outwardly projects from the surface of fan blade 502.

FIG. 6 is an enlarged view showing a stack of sheets 22 attached to the top surface 504 of fan blade 502. In this embodiment, the stack of sheets 22 does not wrap around the leading edge 508 of fan blade 502.

25 FIG. 7 is an enlarged view showing a stack of sheets 22 attached to the bottom surface 506 of fan blade 502. Again, the stack of sheets 22 does not wrap around the leading edge 508 of fan blade 502.

FIG. 8 is an enlarged view showing a stack of sheets 22 attached to the bottom surface 506 of fan blade 502 and wrapped around the leading edge 508 of the blade 502.

30 FIG. 9 is an enlarged exploded view showing a peel off cover 32 being removed in order to attach a stack of sheets 22 to the surface of fan blade 502. Peel off cover 32 attaches

to the bottom side of double sided adhesive strip 28. Once peel off cover 32 is removed, the bottom of double sided adhesive strip 28 is attached to the surface of fan blade 502.

In terms of use, a method for removing pollutants from a gas, includes:

- (a) providing a fan 500 having a fan blade 502 having a surface and a leading edge 508;
- 5 (b) providing a plurality of sheets 22 each sheet 22 having a first side 24 and an opposite second side 26, a tacky substance disposed on first side 24 of each sheet 22, the plurality of sheets 22 arranged in stacked multi-layer relationship wherein the second side 26 of a sheet 22 rests upon the first side 24 of a next lower sheet 22;
- 10 (c) attaching the second side 26 of a bottom sheet 22 of the stack to the surface of the fan blade 502 around the leading edge 508 of the fan blade 502 so that the first side 24 of a top sheet 22 of the stack is exposed to the gas;
- (d) causing the fan blade 502 to rotate through the gas;
- (e) observing when the first side 24 of the top sheet 22 becomes contaminated with airborne pollutants;
- 15 (f) removing the top sheet 22 of the stack to expose an uncontaminated next lower sheet 22 in the stack; and,
- (g) periodically repeating steps (e) and (f).

20 In a more specific embodiment of the invention, a method for removing pollutants from the air, includes:

- (a) providing a fan 500 having a fan blade 502 having a surface;
- (b) providing at least one sheet 22 having a first side 24 and an opposite second side 26, the sheet 22 having a tacky substance disposed of first side 24;
- (c) attaching the second side 26 of the sheet 22 to the surface of the fan blade 502 so
- 25 that the first side 24 of the sheet 22 is exposed to the air; and,
- (d) causing the fan blade 502 to rotate through the air.

The method further including:

- in step (a), fan blade 502 having a leading edge 508;
- 30 in step (c), wrapping sheet 22 around the leading edge 508 of fan blade 502.

The method further including:

in step (a), the fan blade 502 having a length L;

in step (b) the sheet 22 defining an elongated strip; and,

in step (c), attaching the elongated strip along at least half of length L of fan blade 502.

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The method further including:

in step (b), providing a plurality of sheets 22 arranged in stacked multi-layer relationship; and,

(e) as a top sheet 22 becomes contaminated with airborne pollutants, removing the top sheet 22 to expose an uncontaminated next lower sheet 22.

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The method further including:

in step (b), the tacky substance including a pressure sensitive adhesive composed of copolymer microspheres.

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The method further including:

in step (c), attaching the second side 26 of sheet 22 to the surface of fan blade 502 with at least one of an adhesive and a mechanical connector.

20

The method further including:

in step (a), fan blade 502 having a top surface 504 and an opposite bottom surface 506;

in step (c), attaching second side 26 of sheet 22 to top surface 504 of fan blade 502.

The method further including:

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in step (c), providing a bracket 30 disposed between the sheet 22 and the surface of fan blade 502 so that sheet 22 outwardly projects from the surface of fan blade 502.

The method further including:

in step (b) the fan 500 having a plurality of fan blades 502;

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in step (c), attaching at least one sheet 22 to each of the plurality of fan blades 502.

The method further including:

in step (b), sheet 22 including at least one of (1) a fragrance, (2) a biocide, (3) a dye or pigment colorant, and (4) a decorative pattern.

5 FIG. 10 is a perspective view of fan 500 with an alternative embodiment of the air purification device 20 of the present invention attached thereto, and FIG. 11 is an enlarged view in direction 11 of FIG. 10. Also referring to FIGs. 2-4, this embodiment includes a plurality of sheets 22 installed on the surface of fan blade 502 (top surface 504 and bottom surface 506 in the shown embodiment). Each sheet 22 of the plurality of sheets has a first side 10 24 and an opposite second side 26. Each sheet 22 has a tacky substance disposed upon first side 24. The plurality of sheets are arranged in stacked multi-layer relationship wherein first side 24 of each sheet 22 faces in a same direction. The plurality of stacked sheets 22 has a top sheet 22 (farthest from fan blade 502), and a bottom sheet 22 (nearest to fan blade 502). Each of the stacked sheets 22 has a tab 50. Tabs 50 are sized and located so that they may be 15 conveniently grabbed to facilitate removal (peeling off) of a contaminated top sheet 22 to expose the uncontaminated underlying sheet 22. The second side 26 of the bottom sheet 22 is attachable to surface of the fan blade 502 so that the first side 24 of the top sheet 22 is exposed to the air. As fan blade 502 rotates, tacky first side 24 of top sheet 22 collects pollutants from the air.

20 In the shown embodiment, tabs 50 are disposed in staggered relationship. That is, the tabs 50 of individual sheets 22 are offset so that each tab may be viewed. Also in an embodiment of the invention each sheet 22 has indicia disposed upon first side 24, wherein indicia of each sheet 22 differs from the indicia of each other sheet 22. That is, each sheet 22 is marked with unique indicia. In the shown embodiment, the indicia is disposed upon tab 50 25 and represents months of the year (January through December). In this fashion, a user is prompted to remove a pollutant contaminated top sheet 22 at the start of each month.

FIG. 12 is another enlarged view in direction 11 of FIG. 10. In this figure, the first four sheets 22 (January through April) have been removed using tabs 50, to expose the fifth sheet 22 (May).

FIG. 13 is another enlarged view in direction 11 of FIG. 10. In this figure, tabs 50 are not staggered, but rather aligned one on top of the other. In the shown embodiment, the first nine sheets (January through September) have been removed.

FIG. 14 is an enlarged cross sectional view of an alternative embodiment. This embodiment differs slightly from that shown in FIG. 2. In this embodiment stack of sheets 22 is wrapped around the leading edge 508 of fan blade 502 but does not also attach to bottom surface 506 of fan blade 502, but rather hangs below surface 506 of fan blade 502.

A method for removing pollutants from the air (or another gas) utilizing the alternative embodiment outlined above includes:

- (a) providing a fan 500 having a fan blade 502 having a surface;
- (b) providing a plurality of sheets 22, each sheet 22 of said plurality of sheets 22 having a first side 24 and an opposite second side 26, each sheet 22 having a tacky substance disposed upon first side 24, the plurality of sheets 22 arranged in stacked multi-layer relationship wherein first side 24 of each sheet 22 faces in a same direction, the plurality of stacked sheets 22 having a top sheet 22 and a bottom sheet 22, and each sheet 22 having a tab 50;
- (c) attaching second side 26 of the bottom sheet 22 to the surface of fan blade 502 so that first side 24 of top sheet 22 is exposed to the air; and,
- (d) causing fan blade 502 to rotate through the air.

The method further including:
in step (a), fan blade 502 having a leading edge 508; and,
in step (c), wrapping the plurality of sheets 22 around leading edge 508 of fan blade 502.

The method further including:
in step (a), fan blade 502 having a length L
in step (b) the plurality of sheets 22 defining an elongated strip; and,
in step (c), attaching the elongated strip along at least half of the length L of fan blade 502.

The method further including:
in step (b), tabs 50 disposed in staggered relationship.

5 The method further including:
in step (b), each sheet 22 having indicia disposed upon first side 24, wherein the indicia
of each sheet 22 differs from the indicia of each other sheet 22.

10 The method further including:
the indicia disposed upon tab 50.

The method further including:
the indicia representing months of the year.

15 The method further including:
(e) observing when the month disposed on top sheet 22 is over;
(f) using tab 50 to remove the top sheet to expose an uncontaminated next lower sheet
22, wherein the next lower sheet 22 becomes a new top sheet 22; and,
(g) repeating steps (e) and (f) until all sheets 22 have been removed.

20 The method further including:
(e) observing when first side 24 of the top sheet 22 becomes contaminated with
pollutants; and,
(f) using tab 50 to remove top sheet 22 to expose an uncontaminated next lower sheet
25 22, wherein the next lower sheet 22 then becomes the top sheet 22.

The method further including:
in step (b), the tacky substance including a pressure sensitive adhesive composed of
copolymer microspheres.

30 The method further including:

in step (c), attaching second side 26 of the bottom sheet 22 to the surface of fan blade 502 with at least one of an adhesive and a mechanical connector.

The method further including:

5 in step (a), fan blade 502 having a top surface 504 and an opposite bottom surface 506;
and,
in step (c), attaching second side 26 of bottom sheet 22 to top surface 504 of fan blade 502.

10 The method further including:

in step (c), providing a bracket 30 disposed between plurality of sheets 22 and the surface of fan blade 502 so that the plurality of sheets 22 outwardly projects from the surface of fan blade 502.

15 The method further including:

in step (a) fan 500 having a plurality of fan blades 500; and,
in step (c), attaching a plurality of sheets 22 to each of the plurality of fan blades 502.

The method further including:

20 in step (b), each sheet 22 including at least one of (1) a fragrance, (2) a biocide, (3) a dye or pigment colorant, and (4) a decorative pattern.

The preferred embodiments of the invention described herein are exemplary and numerous modifications, variations, and rearrangements can be readily envisioned to achieve
25 an equivalent result, all of which are intended to be embraced within the scope of the appended claims.